

Wastewater Treatment

PBDE Emissions from Wastewater in WA

- Unknown quantity of PBDEs
 - Influent
 - Effluent
- Sewage sludge well-quantified
 - Quantities in WA
 - PBDE concentrations in biosolids from national studies (Hale, North)

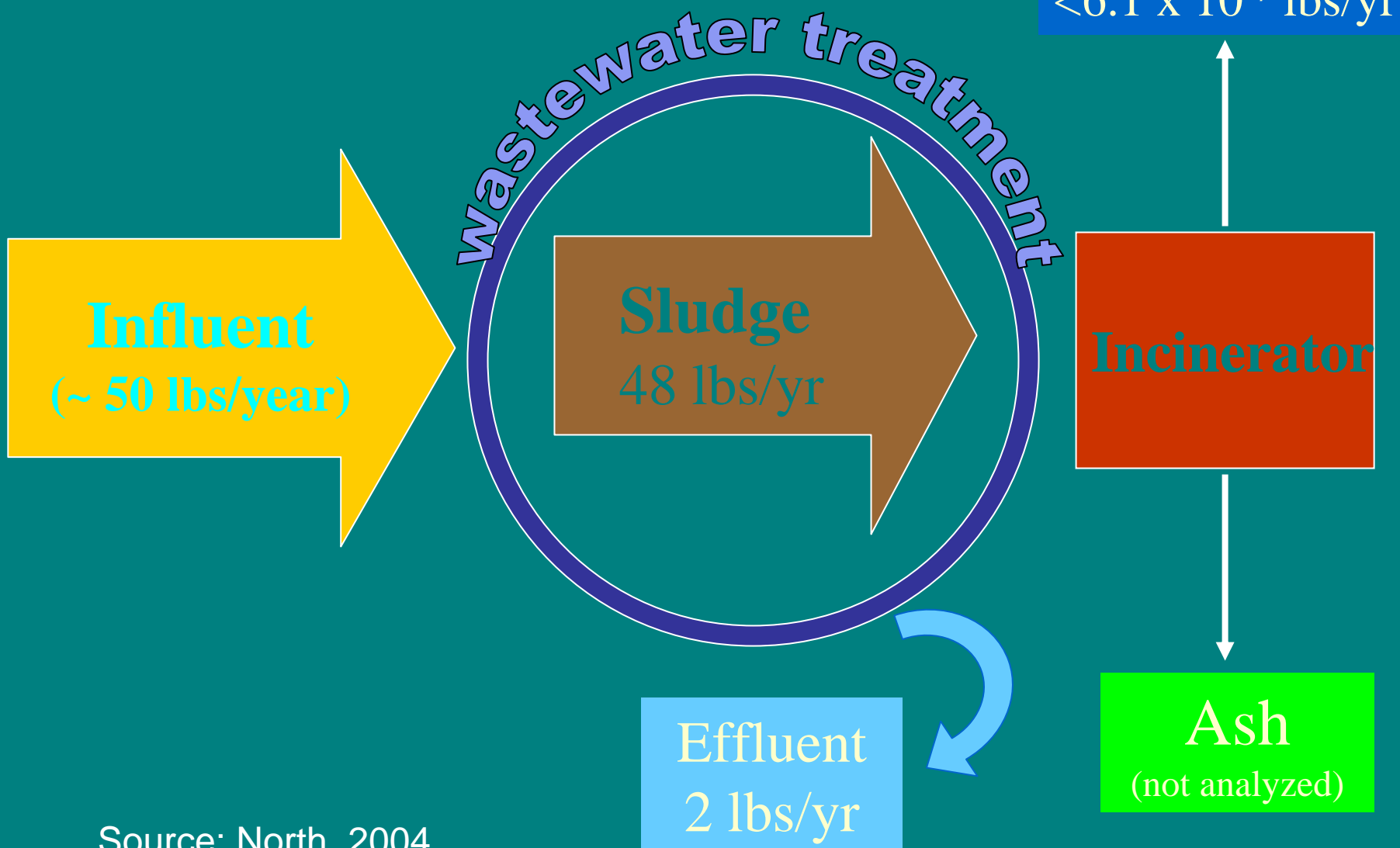
Sewage Sludge and Biosolids in Washington

Sewage Sludge	Annual dry tons	Total PBDEs, lbs., low estimate (Hale)	Total PBDEs, lbs., high estimate (Hale)
Biosolids -- Land Applied	83,280	183	381
Used in Final or Intermediate Landfill Cover (not included in the above land-applied number):	2,956	7	14
Incinerated	15,709	35	72
Disposed in a Landfill	1,732	4	8

Pathways

- Palo Alto tracked PBDEs through sewage treatment process

Fate of PBDEs (Palo Alto wastewater treatment plant)



Source: North, 2004

Pathways, con't

- Land- Swedish study found of sewage sludge amended soils
 - 2 – 13 fold higher concentrations of PBDEs compared to reference plot,
 - Greatest increase for BDE-209
 - PBDEs found in earthworms on amended soil
 - High levels of BDE-209 found on one farm 20 years after last application of sewage sludge
- Groundwater- Rural septic field inputs identified as largest local source to Columbia River in BC (Rayne et al.)
- Water
 - PBDE levels in sediment higher at wastewater treatment outflow in several studies
 - Lower brominated congeners more likely to end up in effluent (North)

Potential Concerns

- Land application of biosolids containing PBDEs may offer route into foodchain through earthworms
- Although PBDE levels in effluent low, levels in sediment at wastewater outfalls relatively high

Key Uncertainties

- Concentration of PBDEs in effluent
- Concentration for PBDEs in WA biosolids
- Concentration of PBDEs at sewage treatment outfalls, impact on ecosystem
- Uptake of PBDEs on soil amended with biosolids

Potential Management Options

- If PBDEs are released in effluent:
 - Look for pretreatment options. Try to identify major sources, if any (e.g., textile plants). If found, try to convince them to substitute some alternative for PBDEs.
 - Require PBDE monitoring in sludge and discharge water, through NPDES permit.
 - No action.
- If PBDEs are in biosolids:
 - Recommend that EPA set biosolids levels for PBDEs.
 - No action.